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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MAHMOUD K. JIBBE

Appeal 2009-004095[1]
Application 10/629,877
Technology Center 2100

Decided: December 9, 2009

Before JEAN R. HOMERE, STEPHEN C. SIU, and JAMES R. HUGHES, *Administrative Patent Judges*.

HOMERE, *Administrative Patent Judge*.

DECISION ON APPEAL

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[1] Filed July 29, 2003. The real party in interest is LSI Logic, Inc. (App. Br. 1.)

I. STATEMENT OF THE CASE

Appellant appeals under 35 U.S.C. § 134(a) (2002) from the Examiner's final rejection of claims 1 through 12 and 14 through 27. Claim 13 has been canceled. We have jurisdiction under 35 U.S.C. § 6(b) (2008).

We affirm.

Appellant's Invention

Appellant invented a method and a system for establishing redundancy in a storage area network (SAN). (Spec. 18, Title and Abstract.) As shown in Appellant's Figure 1, the SAN includes a primary storage array controller module (70) containing a top array controller unit (72) and a bottom array controller unit (74). The SAN also includes a secondary/backup storage array controller module (80) containing a top array controller unit (82) and a bottom array controller unit (84). The SAN further includes an array of storage devices (100) being accessed by the primary controller module (70), which periodically issues an availability signal to the backup controller module (80). Upon failing to receive the signal from the primary storage controller (70) within a predetermined period of time, the backup controller (80) asserts control over the storage devices (100). (Spec. 5-6, para. [0013]-[0014].)

Illustrative Claim

Independent claim 1 further illustrates the invention. It reads as follows:

1. A storage array network, comprising:

a first and second storage array controller module, wherein each storage array controller module has a first and second array controller unit; and

an array of storage devices,

wherein the first storage array controller module is a primary storage array controller that performs storage array controller functions and the second storage array controller module is a redundant back up,

wherein the first storage array controller module provides an availability signal to the second storage array controller module,

wherein if the second storage array controller module does not receive a signal from the first storage array controller module within a given period of time, the second storage array controller module asserts control over the array of storage devices.

Prior Art Relied Upon

The Examiner relies on the following prior art as evidence of unpatentability:

Jantz	5,944,838	Aug. 31, 1999
Sawdy	6,351,831 B1	Feb. 26, 2002
Cruyningen	2002/0019897 A1	Feb. 14, 2002
Ito	2003/0014600 A1	Jan. 16, 2003
Workman	2004/0068591 A1	Apr. 8, 2004
Rauscher	6,874,100 B2	Mar. 29, 2005
Deng	6,937,608 B1	Aug. 30, 2005

Quickloop 2.0, An Advanced Fabric Service for Fibre Channel Loops, Brocade, pub. June 26, 2002 (hereinafter "Brocade").

Rejections on Appeal

The Examiner rejects the claims on appeal as follows:

1. Claims 1, 2, 4, 8, and 9 stand rejected as being unpatentable over the combination of Sawdy, Rauscher, and Cruyningen.

2. Claim 3 stands rejected as being unpatentable over the combination of Sawdy, Rauscher, Cruyningen and Brocade.

3. Claims 5 through 7 stand rejected as being unpatentable over the combination of Sawdy, Rauscher, Cruyningen and Deng.

4. Claims 10 through 12, 14 through 18, 20, and 22 through 27 stand rejected as being unpatentable over the combination of Sawdy, Rauscher, Cruyningen, Workman and Jantz.

5. Claims 19 and 21stand rejected as being unpatentable over the combination of Sawdy, Rauscher, Cruyningen, Workman, Jantz and Ito.

Appellant's Contentions

Appellant contends that the combination of Sawdy, Rauscher and Cruyningen does not teach a first and second storage controller module, each having a first and a second storage controller unit, wherein upon the first controller module failing to provide an availability signal within a predetermined period of time, the second controller module assuming all responsibilities of the first controller module, as recited in independent claim 1. (App. Br. 6-9.) According to Appellant, while Sawdy discloses two controllers, they are not designated as a primary controller and a backup controller. (*Id.* at 6.) Further, Appellant argues that while Rauscher discloses two or more controllers that communicate with one another by

exchanging heartbeat signals, the exchanged signals are not availability signals that are periodically exchanged between the controllers. (*Id.* at 7.) Appellant also argues that while Cruyningen discloses using switches to group a plurality of controllers and storage units within I/O channel partitions, such grouping of disks is not equivalent to grouping a first and a second controller units in each controller module. (*Id.* at 7-8.) Additionally, Appellant argues that there is insufficient rationale to properly combine the teachings of the cited references to render claim 1 unpatentable. (*Id.* at 8.)

Examiner's Findings

The Examiner finds that Sawdy's disclosure of two redundant controllers, each having two identical ports, teaches two controller modules, each having two controller units. (Ans. 11.) The Examiner further finds that Rauscher's disclosure of two controllers exchanging heartbeat signals[2] to initiate a failover procedure therebetween teaches periodically communicating availability signals among the controllers to detect if one of them has failed. (*Id.* at 12.) The Examiner also finds that Cruyningen's disclosure of grouping disk arrays so they can be accessed by any of the controller modules complements Sawdy's system such that if a primary controller fails, the surviving secondary controller can take over the functions of the primary controller. (*Id.* at 13-14.) Additionally, the Examiner concludes that one of ordinary skill in the art would have found

[2] The Examiner relies upon the definition of "heartbeat" provided in The Authoritative Dictionary of IEEE Standard Terms, p.509, 7th Edition, 2000. (*See* Ans. 12.)

sufficient rationale to combine the teachings of the cited references to render claim 1 unpatentable. (*Id.* at 14.)

II. ISSUE

Has Appellant shown that the Examiner erred in concluding that the disclosures of Sawdy, Rauscher, and Cruyningen are properly combined to teach or suggest a first and second storage controller module, each having a first and a second storage controller unit, whereupon the first controller module failing to provide an availability signal within a predetermined period of time, the second controller module assumes all responsibilities of the first controller module?

III. FINDINGS OF FACT

The following Findings of Fact (FF) are shown by a preponderance of the evidence.

Sawdy

1. As shown in Figure 2, Sawdy discloses a redundant array of independent disks (RAID) system having two controllers (210, 212), each containing a first port for accessing a first array of disk drives, and a second port for accessing a second array of disk drives (214, 218). (Col. 2, ll. 11-19.)

2. Sawdy further discloses that the dual controller configuration enhances reliability of the RAID system such that if one controller fails, the

surviving controller assumes the work of the controller pair. (Col. 2, l. 67-col. 3, l. 3.)

Rauscher

3. Rauscher discloses a RAID system that has two or more controllers redundantly arranged to I/O requests from host computers. Col. 2, ll. 10-16.) The controllers exchange heartbeat connect signals with one another to communicate their statuses. (Col. 2, ll. 59-60.) Upon a controller failing to send or respond to a signal, the surviving controller assumes the tasks of the failed controller, and processes all the operations for the RAID system. (Col. 2, ll. 62-67.)

Cruyningen

4. As shown in Figure 3, Cruyningen discloses a data storage system having two controllers (10a, 10b) for accessing two storage arrays (20a, 20b) via two pairs of storage channels (14a1-14a2, 14b1-14b2). (Para. [0034].) Upon detecting that a controller has failed, the switches between the storage arrays are closed such that only the surviving controller has access to all the storage devices via the pair of storage channels associated therewith. (Para. [0038].)

Workman

5. As shown in Figure 1, Workman discloses primary and secondary storage controllers (20, 40) redundantly arranged to access a plurality of single ported storage devices (1, k-1, k, 2k-1) via multiple paths. Each of the controllers includes a processor that runs an algorithm for monitoring the different paths (including the heartbeat path (74)) that

separate them. Upon detecting from the heartbeat path that the secondary controller is operating abnormally, the algorithm activates the primary controller failover (76) to take over the activities of the secondary controller. (Para. [0030]-[0031].)

Jantz

6. Jantz discloses a redundant storage control module referred to as a RDAC (redundant dual-active control/multi-active controllers) that maintains a queue of pending I/O requests. As shown in Figure 3, I/O requests to the RDAC (304) are stored in dispatch queues (306, 308). Copies of the I/O requests are subsequently stored in the I/O queue (312). (Col. 6, l. 56 - col. 7, l. 5.)

IV. PRINCIPLES OF LAW

Obviousness

Appellants have the burden on appeal to the Board to demonstrate error in the Examiner's position. *See In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) ("On appeal to the Board, an applicant can overcome a rejection [under § 103] by showing insufficient evidence of *prima facie* obviousness or by rebutting the *prima facie* case with evidence of secondary indicia of nonobviousness.") (quoting *In re Rouffet*, 149 F.3d 1350, 1355 (Fed. Cir. 1998)).

> Section 103 forbids issuance of a patent when "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been

> obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007).

In *KSR*, the Supreme Court emphasized "the need for caution in granting a patent based on the combination of elements found in the prior art" and discussed circumstances in which a patent might be determined to be obvious. *Id.* at 415 (citation omitted). The Court reaffirmed principles based on its precedent that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *Id.* at 416. The operative question in this "functional approach" is thus "whether the improvement is more than the predictable use of prior art elements according to their established functions." *Id.* at 415, 417.

The Federal Circuit recently recognized that "[a]n obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of a case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not." *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1161 (Fed. Cir. 2007) (citing *KSR*, 550 U.S. at 416). The Federal Circuit relied in part on the fact that Leapfrog had presented no evidence that the inclusion of a reader in the combined device was "uniquely challenging or difficult for one of ordinary skill in the art" or "represented an unobvious step over the prior art." *Id.* at 1162 (citing *KSR*, 550 U.S. at 417-418).

One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (citing *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). .

The test for obviousness is what the combined teachings of the references would have suggested to one of ordinary skill in the art. *See Kahn*, 441 F.3d at 987-988 (citation omitted); *In re Young*, 927 F.2d 588, 591 (Fed. Cir. 1991) (citing *In re Keller*, 642 F.2d at 425). Moreover, in evaluating such references it is proper to take into account "not only the specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom." *In re Preda*, 401 F.2d 825, 826 (CCPA 1968) (citation omitted).

V. CLAIM GROUPING

Appellant argues the patentability of claims 1 through 9 in conjunction with the rejection of claims 1. Appellant argues the patentability of claims 10 through 12, 14 through 27 in conjunction with the rejection of claims 10 and 22. In accordance with 37 C.F.R. § 41.37(c)(1)(vii), we will consider the claims on appeal as standing and falling with representative claims 1, 10 and 22.

VI. ANALYSIS

Independent claim 1 requires, in relevant parts, a first and second storage controller module, each having a first and a second storage controller

unit, whereupon the first controller module failing to provide an availability signal within a predetermined period of time, the second controller module assumes all responsibilities of the first controller module.

As set forth in the Findings of Facts section, Sawdy discloses a RAID system having two controllers, each having a pair of ports for accessing two arrays of disks. (FF. 1.) Further, Sawdy discloses that the controllers are arranged in a redundant fashion such that if one controller fails, the other can take over to process all I/O requests in the systems. (FF. 2.) Next, Rauscher discloses a RAID having two or more redundantly arranged controllers that periodically exchange heartbeat signals to inform one another of their operating statuses. (FF. 3.) Upon detecting a controller's failure to respond to a heartbeat signal, another controller takes over the responsibilities of the non-responsive controller to process the I/O operations of the RAID. (*Id.*) Additionally, Cruyningen discloses a data storage having two controllers for accessing arrays of disk drives. (FF. 4.) Upon detecting that one of the controllers has failed, the system that utilizes a switching mechanism to transfer all tasks of the failed controller to the surviving one. (*Id.*)

We find that the two ports disclosed in each of Sawdy's controllers serve as conduits for accessing the disk drives. In particular, similarly to the claimed array controller units, they serve as interfaces through which the controllers access the disk dives. We thus agree with the Examiner that Sawdy's ports teach the controller units. (Ans. 11.) Further, since Appellant has failed to address in a Reply Brief this new finding made by the Examiner in the Answer, the Examiner's finding as to this point is unrebutted.

Next, we find that Rauscher's disclosure of exchanging heartbeat signals among the controllers to inform one another of their statuses teaches the claimed availability signals since the transmission of status or the failure thereof indicates whether a controller is operating properly and whether it is thereby available to process I/O requests. Further, we find that each of Rauscher's controllers needs to transmit or receive an availability signal within a predetermined period of time to prevent other controllers from usurping their operating functions. (FF. 3.)

Additionally, we find that Cruyningen's disclosure of switching the operating functions of a failed controller to a surviving controller cumulatively reinforces the teachings Sawdy and Rauscher. It is therefore our view that Sawdy, Rauscher and Cruyningen disclose prior art elements that perform their ordinary functions to predictably result in a RAID having two redundantly arranged controller modules, each having two controller units for accessing an array of disk drives, whereupon one of the controllers failing to exchange or acknowledge an availability signal within a predetermined period of time, the other controller takes over its operating functions. Therefore, Appellant's argument that the cited references are not properly combined is not persuasive. It follows that Appellant has not shown that the Examiner erred in concluding that the combination of Sawdy, Rauscher and Cruyningen renders claim 1 unpatentable.

Regarding claim 10, Appellant argues that the combination of Sawdy, Rauscher, Cruyningen, Workman, and Jantz does not teach a handshaking protocol between the two controllers for determining which of the

controllers is used to process a received command. (App. Br. 11.) According to Appellant, while Workman discloses controllers that monitor each heartbeat connection to act if a connection is interrupted, there is no negotiation or mutual agreement between the communicating devices in Workman to warrant a handshaking protocol. (*Id.*) In response, the Examiner finds that Workman's disclosure of a primary controller and a secondary controller monitoring a heartbeat path to determine whether a controller should take over the responsibilities of another controller when it is operating abnormally teaches the handshaking protocol.[3] (Ans. 15-16.)

We first consider the scope and meaning of the terms "*handshaking protocol,*" which must be given the broadest reasonable interpretation consistent with Appellant's disclosure, as explained in *In re Morris*, 127 F.3d 1048 (Fed. Cir. 1997):

> [T]he PTO applies to the verbiage of the proposed claims the broadest reasonable meaning of the words in their ordinary usage as they would be understood by one of ordinary skill in the art, taking into account whatever enlightenment by way of definitions or otherwise that may be afforded by the written description contained in the applicant's specification.

Id. at 1054. *See also In re Zletz*, 893 F.2d 319, 321 (Fed. Cir. 1989) (stating that "claims must be interpreted as broadly as their terms reasonably allow."). Appellant's Specification states the following:

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[3] The Examiner relies upon the definition for handshaking (An interlocked exchange of signals between a master and a slave, controlling the transfer of data) provided in The Authoritative Dictionary of IEEE Standard Terms, p.503, 7th Edition, 2000.

> The primary array controller module (PM) and the second array controller module engage in a timed handshaking protocol 230. If the primary array controller module successfully handshakes with the second array controller module within a given time, the primary array controller module retains control of the command 240 and processes the command 250. In an embodiment, if the primary array controller module processes the command, the primary array controller module may remove the command (as by deleting from a queue) such that the secondary array controller module is prevented from assuming control even if the module handshaking protocol were to fail. In another embodiment, if the primary array controller module unsuccessfully handshakes with the secondary array controller module, the secondary array controller module assumes control for processing the command 260, 250. After the command is processed, a new command may be retrieved from the queue 220.

(Spec. 7, para [0015].)

Our reviewing court further states, "the 'ordinary meaning' of a claim term is its meaning to the ordinary artisan after reading the entire patent." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1321 (Fed. Cir. 2005).

Upon reviewing Appellant's Specification, we find no explicit definition for the claim terms "*handshaking protocol*." We therefore construe the cited terms in accordance with its ordinary meaning. We note that Appellant has not provided any authority for the definition offered at page 11 the Brief. We therefore adopt the broader dictionary definition provided by the authority cited in the Examiner's Answer.[4]

[4] *See* The Authoritative Dictionary of IEEE Standard Terms, p.503, 7th Edition, 2000 (defining handshaking as the exchange of predetermined

As detailed above, both Rauscher and Workman disclose using algorithms that monitor the heartbeat paths between two redundantly arranged storage controllers to determine whether any of the controllers is not operating properly, and if so, transferring its operating functions to the surviving controller. (FF. 3, 5.) We find that, pursuant to the definition adopted above, by exchanging heartbeat signals between the two controllers to determine the availability statuses of the controllers, and to subsequently transfer the activities of a failing controller to a surviving controller, both Rauscher and Workman teach using a handshaking protocol to determine which of the controllers will be processing a request. It follows that Appellant has not shown that the Examiner erred in concluding that the combination of Sawdy, Rauscher, Cruyningen, Workman, and Jantz renders claim 10 unpatentable.

Regarding claim 22, Appellant argues that the combination of Sawdy, Rauscher, Cruyningen, Workman and Jantz does not teach storing a command within two separate queues. (App. Br. 12.) We do not agree. As detailed above, Jantz discloses a low level disk driver that maintains dispatch queues for buffering I/O requests made by RDAC. (FF. 6.) Further, copies of the requests are stored in the I/O queues. (*Id.*) We find that the I/O requests are commands that are redundantly stored in separate queues. It follows that Appellant has not shown that the Examiner erred in

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signals or control measures between two systems or system components upon initial exchanges).

concluding that the combination of Sawdy, Rauscher, Cruyningen, Workman and Jantz renders claim 22 unpatentable.

VII. CONCLUSION OF LAW

Appellant has not established that the Examiner erred in rejecting claims 1 through 12 and 14 through 27 as being unpatentable under 35 U.S.C. § 103(a).

VIII. DECISION

We affirm the Examiner's rejection of claims 1 through 12 and 14 through 27.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

nhl

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